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B.A.N.Z.
ANTARCTIC RESEARCH EXPEDITION

1929–1931

UNDER THE COMMAND OF SIR DOUGLAS MAWSON, Kt., O.B.E., B.E., D.Sc., F.R.S.

REPORTS—SERIES B (Zoology and Botany)

VOLUME VIII

PART 2

CHAETOGNATHA

By

P. M. DAVID

ADELAIDE

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PART 2

CHAETOGNATHA

By
P. M. DAVID

[B.A.N.Z.A.R.E. Reports, Series B, Vol. VIII, Part 2, pages 73-79, Tables 1-6]

Issued November, 1959

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CHAETOGNATHA

By

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Submitted for publication, June, 1958.

INTRODUCTION.

The collection of Chaetognatha reported upon in this paper consisted of some twenty tubes of specimens sorted in Australia from some of the plankton hauls made by S.Y. "Discovery" during the B.A.N.Z.A.R. Expedition of 1929-31. This collection is a small one, though the complete collections made by the Expedition are quite extensive, and the samples are mainly from the Antarctic and Subantarctic waters of the Indian Ocean sector of the Southern Ocean.

Because the principle requirement of the Expedition was to land on the Antarctic continent the ship was on passage and working at sea only in the summer months (i.e. from October, 1929, to March, 1930, and from November, 1930, to March, 1931). The value of the collection, on its own, therefore, is mainly systematic, but considered in the light of the data collected by the ships of the Discovery Committee, it adds considera ble confirmation of the results deduced from those data.

MATERIAL AND METHODS.

All the specimens received were preserved in neutral sea water formalin and many of them were in good condition. Specimens from large deep nets such as the N 200 used on this expedition seldom reach the deck of a ship undamaged as the weight and amount of material in the bucket of the net and the long time of fishing and hauling combine to cause often considerable damage to the large delicate forms such as mature specimens of *Sagitta gazellae*. A certain amount of distortion had been caused by the subsequent use of too small tubes for sorted specimens, however, neither of these factors affects the results to any large extent as the chaetognaths found in the Southern Ocean are all easily recognisable without recourse to features such as the corona or the fins, which are those most easily damaged.

The material reported on consisted of sorted specimens from nineteen net hauls and thus represents only a small part of the total hauls made. With the exception of one N 70 V haul, none of the nets represented was closed after fishing, and it must be remembered in considering the data from deep nets, presented later, that a certain amount of contamination from shallower horizons is bound to arise when this method is used.

Table 1 shows the number of hauls with each of the nets used.

TABLE 1.

The numbers of each kind of net haul represented in the collection.

Two metre net fished horizontally (N 200 H)	11*
One metre net fished horizontally (N 100 H)	1
One metre net fished obliquely (N 100 B)..	3
Seventy centimetre net fished vertically (N 70 V) ..	1
Large monagasque trawl (TML)	3

* The haul at Station 111 marked in the Station List and on the label should in fact have been described as N 200 B (see Station List, Johnston, 1937, 38).

The TML fishes on the bottom and only catches plankton incidently while being hauled open to the surface. In the present collections three chaetognaths were taken in three hauls, all were badly damaged, and I have disregarded them for the purpose of this paper.

Although a large number of 70 cm. nets were fished vertically during the expedition only one haul was included in the collection which I received; similarly there were but three N 100 H hauls and one N 100 B haul in the collection. The presence of species in these hauls is of some value systematically and distributionally; but because only a few hauls were available the absence of species from them must not be regarded as a certain indication of the absence of the species from the area in which the net was fished. There remain therefore the ten horizontal hauls made with the N 200, and these represent a small but useful series ranging in depth from about 1500 m. to 750 m. These were all fished open to the surface, but as will be seen from the distributional section (p. 77) this can be, to some extent, allowed for.

In most cases the depth to which a net fished has not been given in the Station List, but the length of wire out expressed in metres has been given instead. With the advice of Mr. J. W. S. Marr I have given the probable depth of fishing as half the amount of wire out except when the depth was estimated on board

and recorded in the Station List, as for example at Station 27 when 1500 m. of wire out was estimated to have given a fishing depth of 1000 m. (such an estimate would have been reached by consideration of the angle of the wire, the speed of the ship and the state of the sea and wind by someone experienced at working nets in all conditions). Though this simple rule may not be correct for all lengths of wire, it has been found by the use of a depth gauge to give a close approximation with all but the deepest of hauls. This was confirmed at Stations 96 and 111 when a modified Kelvin tube gave depths of 1160 m. with 2200 m. of wire and 1710 m. with 3450 m. of wire respectively.

SYSTEMATICS.

The Chaetognath fauna of the Southern Ocean is well known and it is therefore not surprising that the present collection contained no new forms. Of the seven species which maintain themselves in the area south of the subtropical convergence five were present in the BANZARE collection. Three of the eight "exotic" species occasionally found in subantarctic waters (David 1958) were also present.

The two endemic species not found in this collection were *Eukrohnia bathyantarctica* David, 1958, and *Heterokrohnia mirabilis* Ritter-Zahony, 1911.

Table 2 shows the numbers of each species examined and the depths at which the nets were fished, the exact positions of the stations can be found by reference to the Station List (BANZARE Rep. Series B Vol. 1, Part 1), but in Table 2 I have indicated the zone in which each haul was made by the letters A, = Antarctic, S.A., = subantarctic, and S.T., = subtropical.

TABLE 2.

The numbers of specimens of each species found at the stations listed and the zones in which the stations were made.

Station No.	Net	Depth	*S. gazellae*	*S. maxima*	*S. marri*	*E. hamata*	*S. serratodentata*	*S. lyra*	*S. hexaptera*	*S. macrocephala*	*S. zetesios*	*Zone
27	N 200 H	1000(—0) m.	46	16	10	91	0	0	0	1	0	A
29	TML	1266 m.	1	0	0	0	0	0	0	0	0	A
31	N 200 H	1000 (—0) m.	22	4	9	81	0	0	0	0	0	A
32	N 200 H	750 (—0) m.	2	0	1	3	0	0	0	0	0	A
34	N 100 H		2	2	0	24	0	0	0	0	0	A
35	N 200 H	1570 (—0) m.	0	2	1	55	0	0	0	0	0	A
38	N 100 B	128-0 m.	1	0	0	0	0	0	0	0	0	A
44	N 100 B	137-0 m.	2	0	0	1	0	0	0	0	0	A
45	N 200 H	1000 (—0) m.	30	13	4	10	0	0	0	0	0	A
66	TML	3112 m.	1	0	0	0	0	0	0	0	0	S.A.
67	N 200 H	1000 (—0) m.	87	35	0	16	0	0	0	0	23	S.A.
69	N 200 H	1500 (—0) m.	128	27	1	9	0	6	0	0	19	S.A.
70	N 100 B	160-0 m.	95	0	0	48	5	0	0	0	0	S.A.
73	N 200 H	500 (—0) m.	0	0	0	0	0	16	1	0	1	S.T.
93	TML	2267 m.	1	0	0	0	0	0	0	0	0	A
	N 200 H	750 (—0) m.	51	28	7	95	0	0	0	0	0	A
95	N 70 V	?	4	0	19	32	0	0	0	0	0	A
96	N 200 H	1160 (—0) m.	30	11	4	35	0	0	0	0	0	A
111	N 200 H	1710-0 m.	21	0	0	0	0	0	0	0	3	S.A.

SAGITTA GAZELLAE Ritter-Zahony, 1909.

Both races of this species were present, and at Station 69 *S. lyra* and *S. gazellae* were present in the same haul; there were no signs of the supposed "intermediate" forms described by various authors.

SAGITTA MARRI David, 1956.

The specimens agreed closely with the description from Discovery collection material. At Station 69 *S. zetesios* was present in the same haul.

SAGITTA MAXIMA (Conant, 1896).

The specimens were of the normal Southern Ocean form, none exceeded 55 mm. total length.

SAGITTA MACROCEPHALA Fowler, 1905.

One specimen only of this species was taken.

EUKROHNIA HAMATA (Mobius, 1875).

Relatively few specimens were taken of this species.

SAGITTA HEXAPTERA d'Orbigny, 1843.

This species only occurs once.

Sagitta lyra Krohn, 1853.

One of the specimens at Station 63 was 37 mm. in length at Stage II maturity and had six and eight hooks as compared with ten and twelve hooks in *S. gazellae* of the same length.

Sagitta serratodentata Krohn, 1853.

This species was taken only from Station 70.

Sagitta zetesios Fowler, 1905.

This species occurred in four separate hauls. Some of the specimens from Station 69 were remarkably large and advanced in maturity. Table 3 gives size and formulae for the three largest specimens (1, 2, 3). The formulae fit well with the data I have presented in a previous paper (David, 1956).

TABLE 3.

Formulae for three large species of *S. zetesios* (1, 2, 3) and two doubtful species (4, 5) from Station 69.

	Total length mm.	Tail seg. mm.	Hooks	Ant. teeth	Post. teeth	Maturity
1	43	10	6/7	5/5	9/10	IV.
2	39	9	7/8	6/6	11/14	III.
3	38	9	7/8	6/6	13/14	II.
4	34		8/8	7/7	5/7	
5	33		4/5	8/8	10/10	

Two specimens tentatively assigned to *S. zetesios* were taken at Station 67; these seemed from their posterior teeth to be *S. planctonis* Steinhaus, but they were not in good condition and it was therefore difficult to decide. Table 3 gives their size and relevant formulae (4, 5). The twenty-one other specimens in the same haul appeared to be quite normal *S. zetesios*.

DISTRIBUTION.

For the purposes of this section the N 200 H hauls will mainly be considered as they give easily comparable results having been fished mostly at about 1000 m. and all hauled open to the surface. This series of nets falls into three groups, according to the three zones in which they were fished; there were seven hauls in the Antarctic, two hauls in the subantarctic, and one haul in the subtropics.

The Antarctic hauls were nearly all within the influence of the East Wind drift, that is the westward moving counter current close to the Antarctic Continent (Deacon, 1936, p. 14 *et seq*), the subantarctic hauls were in the northern part of the zone, and the subtropical haul was in the southern part of the zone.

It has already been mentioned that two endemic antarctic species *E. bathyantarctica* and *H. mirabilis* were not found in the Banzare material. *E. bathyantarctica* has been found within the area surveyed by the expedition but is rare above 1500 m. and its absence from the present collection is probably due to the small number of hauls available. *H. mirabilis* is probably also circumpolar but does not appear to be common, it has only been taken below 2000 m., thus its absence is not unexpected.

Table 4 summarises the data for the four common species taken in the nine N 200 H hauls made to the south of the subtropical convergence, a correction has been made to standardise the length of tow to one hour.

TABLE 4.

Two metre hauls, data for the four common Antarctic species.

The number of animals shown in brackets represent those corrected for one hour fishing time.

Station*	Depth m.	Time	*S. gazellae*	*S. maxima*	*S. marri*	*E. hamata*
Antarctic zone						
27	1000 (—0)	1 hr.	46 (46)	16 (16)	10 (10)	90 (90)
31	1000 (—0)	1½ hrs.	22 (14)	4 (3)	9 (6)	81 (54)
32	750 (—0)	1 hr.	2 (2)	0	1 (1)	3 (3)
35	1570 (—0)	2 hrs.	0	2 (1)	1 (½)	56 (28)
45	1000 (—0)	2 hrs.	30 (15)	13 (7½)	4 (2)	10 (5)
93	750 (—0)	1 hr.	51 (51)	28 (28)	7 (7)	95 (95)
96	1160 (—0)	1½ hrs.	30 (22)	11 (9)	4 (3)	35 (35)
		Total	180 (150)	74 (62½)	36 (29½)	370 (308)
		Average	26 (21.4)	10.5 (9)	5 (4.2)	53 (44)
Subantarctic zone						
67	1000 (—0)	1 hr.	87 (87)	35	0	16
69	1500 (—0)	1 hr.	128 (128)	27	1	9
		Total	215	62	1	25
		Average	107	31	½	12½

* Stations 111 and 73 have been omitted from this Table, the haul at Station 111 was an N 200 B not H and thus not comparable, and Station 73 was in the Subtropical zone and contained none of the four common antarctic species.

S. gazellae. I have shown elsewhere (David, 1955) that the population of this species is much greater in the subantarctic than in the Antarctic, the actual figures (per 20 m. haul with a one m. oblique net) were 120.3 average of 165 subantarctic hauls and 27.2 average of 331 Antarctic hauls. From Table 4 it can be seen that in the present material the average number per one hour haul (figures in brackets) for the Antarctic was 21.4 and for the subantarctic 107, a ratio of approximately 1 to 5 which is in very close agreement with the ratio of 1 to 4½ of the "Discovery II" data mentioned above. The BANZARE hauls were made entirely in the 1500-750 m. layer mostly at about 1000 m. which is the depth range within which mature specimens of *S. gazellae* have been taken by previous expeditions (David, 1955) (and indeed the collection is remarkable for the relatively large number of mature specimens it contains), whereas the "Discovery II" data referred to above were based upon counts of immature specimens taken at the surface. The close agreement of the ratio of Antarctic to subantarctic mature specimens with that of the immatures seems to suggest that no horizontal concentration takes place among the mature specimens (an occurrence which might have gone some way to explaining the apparent rarity of the mature forms), for it would be highly improbable that so few hauls could have given these figures had there been any considerable degree of swarming taking place. It would seem at first sight that this agreement in the ratios is additional evidence that the Antarctic and subantarctic populations are discrete, but unfortunately the two sets of hauls are widely spaced geographically and none of the hauls are in the region, in the vicinity of the Antarctic convergence, where a change in the ratios would be expected if mixing of the two races took place.

I have remarked earlier that the range of the mature specimens was between 750 and 1500 m. and the point has been demonstrated in the "Discovery II" data referred to. The present material, however, gives striking and independent confirmation of this important point as Table 5 shows.

TABLE 5.

The depth distribution of the stages of maturity of *S. gazellae.*

Depth	Number of hauls	Stages				
		I.	II.	III.	IV.	V.
500-0	3	99 100%	0	0	0	0
1000-500	4	26 63.4%	15 36.6%	0	0	0
1500-1000	4	59 40.4%	56 38.8%	25 17.2%	4 2.7%	2 1.3%
2000-1500	2	75 53.5%	47 33.5%	17 12.3%	1 0.71%	0

All relevant hauls have been used in this table, not only the N 200 H data.

In this table one N 100 H and three N 100 B hauls have been used in addition to the N 200 H series, in order to amplify the data from the two shallow horizons.

TABLE 6.

The depth distribution of the stages of maturity of *S. gazellae*, a comparison of BANZARE and "Discovery II" material. Numbers of each stage are expressed as a percentage of the total number for each depth horizon.

B, BANZARE material; D, "Discovery II" material.

Depth	Stages									
	I		II		III		IV		V	
	B	D	B	D	B	D	B	D	B	D
500-0	100	96	0	4	0	0	0	0	0	0
1000-500	63·4	59·0	36·6	33·4	0	7·6	0	0	0	0
1500-1000	40·4	30·0	38·3	15·0	17·2	45·0	2·7	10·0	1·3	0

In Table 6 the percentages of each stage of maturity for the three depth horizons to 1500 m. have been compared with the vertical closing net (N 70 V) data from "Discovery II" (David, 1955, Table 15, p. 271). In comparing these figures it must be remembered that the BANZARE nets were fished open to the surface whereas the "Discovery II" ones were closed, thus contamination from the shallow horizons has raised the numbers of Stage I and II animals in the deeper hauls and thus reduced the percentage of the matures in those hauls. It is not possible with the present data to make any correction for this contamination, but a mental allowance for it should be made when examining Tables 5 and 6. It can be seen that the depth distribution of the mature stages is shown to be substantially the same in both collections.

Two stations, 73 and 111, help to define the northern limits of *S. gazellae*, at Station 73, 38° 33′ S. (surface temperature 15.78°C.) the species is absent, whereas at Station 111, 44° 11′ S. (surface temperature 12.00°C.) twenty-one specimens were taken.

S. marri. This endemic Antarctic form was taken in small numbers at nearly all the Antarctic stations, it was absent from the shallow N 100 B hauls at Stations 38 and 44 and from the N 100 H haul (360 m. depth)

at Station 34, but present in all the other hauls. It was absent from four of the five subantarctic hauls, one specimen being taken from the N 200 H haul at Station 69. These occurrences agree well with the known distribution of the species which is mainly found in the warm deep water of the Antarctic zone, that is between about 200 and about 1200 m., with occasional specimens straying into deep water in the subantarctic zone.

S. maxima. This species occurred frequently in both subantarctic and Antarctic hauls being absent only from Station 32. It is usually found to be more abundant in the subantarctic, and the present catch figures tend to bear this out (see Table 4), the average catch adjusted for a one-hour tow was nine for the seven Antarctic hauls and thirty-one for the two subantarctic ones. The species was not taken at the subtropical station.

Eukrohnia hamata. The rather small catch figures for this species suggest that many specimens were not retained by the large mesh net, for it is usually the most abundant Southern Ocean species.

S. serratodentata. Only five specimens taken, at Station 70 (surface temperature 11.78° C.) fairly near the subtropical convergence.

S. lyra. Two hauls totalling twenty-two specimens were made at Stations 69 and 73, the latter position was in subtropical water, nor was Station 69 far from the subtropical convergence.

S. hexaptera. One specimen only taken at Station 73 in subtropical water.

S. macrocephala. One specimen at Station 27 at a depth of 1000 m. in Antarctic water. The species has been reported previously from Antarctic waters but is rather rare.

S. zetesios. Occurred at four stations, one specimen at Station 73 in the subtropics, twenty-three at Station 67, nineteen at Station 69 and three at Station 111 all in the subantarctic.

The record at Station 67, 45° 53′ S., shows that this, normally subtropical species, can penetrate quite a distance into subantarctic waters and that its distribution as a stray can overlap that of *S. marri*.

DISCUSSION.

The data from the BANZARE chaetognath collection seem to confirm those from the "Discovery" collections, and it would now seem that the general pattern of distribution of the species found in the Southern Ocean is fairly clearly defined. Future work should be aimed at delineating more closely the distribution on a local scale in the regions of the convergences, and more work is required on the life history of the commoner forms.

ACKNOWLEDGEMENTS.

I am most grateful to Sir Douglas Mawson, leader of the BANZAR Expedition, for entrusting me with the material and with the preparation of a report on it. I am also indebted to Mr. J. W. S. Marr (who was, in a large part, responsible for the collection of the material and its preservation in the field in 1929 and 1930, when he was serving aboard S.Y. "Discovery") for advice, explanation of the methods used and for estimating the fishing depth of the nets from the length of wire out.

SUMMARY.

A small representative collection of chaetognaths from the BANZAR Expedition has been examined. It confirms the pattern of distribution which has been recently described and published from other expeditions.

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